Pipunculidae (Diptera) Parasitic on Rice Leafhoppers in the Oriental Region[1]

D. Elmo Hardy
University of Hawaii
Honolulu, Hawaii

The importance of Pipunculidae as biological control agents has never been thoroughly assessed. These flies are all parasitic on several families of Homoptera, especially Cicadellidae, Delphacidae and Cercopidae, and no doubt are of significance in keeping some pest species of leafhoppers in check. Studies of the species associated with rice leafhoppers have been made by K. Koizumi, in Japan (1959 and 1960) and by Kwei-shui Lin, on Taiwan. Koizumi reared four species from *Nephotettix cincticeps* Uhler, one species from *Inazuma dorsalis* (Motschulsky) and treated two species which appear to be associated with *Psamotettix striatus* (Linn.).

Nine species, in three genera, are in the collection made by Dr. Lin during his study on Taiwan. Six of these have been reared from *Nephotettix cincticeps* and the other three were collected in paddy fields and are probably associated with this leafhopper. Pipunculids are usually abundant in the paddy fields.

Key to Identify Paddy Inhabiting *Pipunculidae* from Japan and the Oriental Region (*modified from Koizumi*, 1960)

1. Third costal section, between apices of veins Sc and R_1 very short, about one-third as long as fourth and with no stigma.....2
   Third costal section equal to or longer than fourth and colored with brown.....*Pipunculus* (Eudorylas) Aczél...9
2. Crossvein r-m situated at or near middle of cell 1st M_2. Anal cell, axillary incision and alula well developed. Eyes of male touching on front.....*Tomosvaryella* Aczél...3
   Crossvein r-m at basal sixth of 1st M_2. Basal portion of anal cell and alulu greatly narrowed, no axillary incision. Eyes of male separated on front.....
   .....Host: unknown...Taiwan, Philippines...*Dorylomorpha lini* n. sp.
3. Humeri black.....4
   Humeri yellow-white.....5
4. Wings distinctly brownish tinged. Abdomen lightly pollinose on the dorsum, gray on sides and rather densely covered

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with short, suberect setae. Male terminalia short, about one-third as long as fifth abdominal segment. Surstyli blunt, rounded at apices. Female ovipositor small, piercer about as long as base and upcurved...Host: *Nephotettix cincticeps*. Japan, Taiwan, Philippines, Thailand; Borneo; Vietnam and Assam, India.....*oryzaetora* (Koizumi)

Wings hyaline. Abdomen polished black, lacking gray markings, rather sparsely covered with long erect hairs. Male terminalia one-half as long as fifth, surstyli truncate at apices. Ovipositor large, piercer about two times longer than base and slightly down curved...Host: *Inazuma dorsalis* (Motschulsky)... Japan.....*inazumae* (Koizumi)

5. Male terminalia, as seen from dorsal view, asymmetrical, with a prominent apical membranous area. Hind trochanters lacking a square topped process below.....6

Male terminalia symmetrical, subhemispherical in shape and with a longitudinal suture on right side. Hind trochanter with a square topped densely white pubescent ridge below extending most of its length. Each front femur with a pair of prominent black ventral setae near base...Host: *Nephotettix cincticeps* and probably other grass infesting leafhoppers... nearly cosmopolitan.....*subvirescens* (Loew)

6. Male with a longitudinal furrow (membranous area) completely dividing the terminal segment down the middle, as seen from dorsal view.....7

Male with an apical membranous area, not bisecting segment above 8

7. Hind trochanter of male with a mound-like gibbosity or ridge below; this is densely covered with short black setae or spicules (Fig. 2a). Male genitalia as in Fig. 2b–c...Host: probably *Nephotettix cincticeps*. Taiwan and Philippines.....*spiculata* n. sp.

Trochanter not bearing a ventral ridge or carina, with four to five black hairs near base below. Surstyli of male long and slender (ref. Koizumi, 1960: 39 Fig. 40)...Hosts: *Psamotettix striatus* (Linn.) and *Nephotettix cincticeps*...nearly cosmopolitan .....*sylvatica* (Meigen)

8. Hind femora with prominent postero-ventral cilia. Epandrium about as wide as long. Surstyli triangular, sharp pointed (ref. Koizumi, 1960: 37, Fig. 20)...Host: Probably *Psamotettix striatus* (Linn.)...Japan.....*itoi* (Koizumi)

Hind femora lacking prominent posterior cilia. Epandrium nearly two times longer than wide and surstyli long and slender (ref. Koizumi, 1960: 37, Fig. 3D)...Host: Unknown... Widespread, Japan, Palaearctic and Nearctic Regions.....

.....*coquilletti* (Kertész)

9. First tergum of abdomen with a row of prominent bristles on each side. Male terminalia asymmetrical, with a prominent membranous area. Epandrium not visible from dorsal view.....10

First tergum bare on sides. Terminalia symmetrical, subglobose, lacking a membranous area and with epandrium plainly visible from above...Host: *Nephotettix cincticeps*...Taiwan, Philippines, Thailand, Vietnam and Laos.....*roralis* (Kertész)

10. Male terminalia not with a longitudinal cleft on right side and with a large conspicuous apical membranous area. Third antennal segment brown to black; legs mostly black.....11

Terminalia with a longitudinal cleft on right side completely bisecting the eighth tergum, as seen in dorsal view. Third antennal segment, tibiae and broad bases and apices of femora yellow...Host: *Nephotettix cincticeps*...widespread over Orient, Pacific, Australia.....*mutillatus* Loew

11. Vein Cu_1 + 1st A elongate, nearly two times longer than m-cu crossvein and subequal to m crossvein. Front and middle tibiae each with a prominent erect posterior seta beyong middle of segment. Third costal section nearly two times longer than fourth. Male terminalia with the membranous area extending over the dorsum nearly bisecting the eighth segment. Female ovipositor straight. Apices of terga broadly gray...Host: *Nephotettix cincticeps*...Japan, Taiwan, widespread over Orient.....*orientalis* (Koizumi)

Cu_1 + 1st A rather short, about equal in length to m-cu crossvein. Third costal section about equal to fourth. Front and middle tibiae lacking erect posterior setae. Terminalia with membranous area confined to apex of eighth. Terga mostly opaque brown, gray on sides...Host: *Nephotettix cincticeps*...Japan, widespread over Oriental Region.....
.....*javanensis* de Meijere

The following notes are based upon materials collected by K. S. Lin during his studies of rice leafhopper parasites on Taiwan, with distributional data added from other collections.

Dorylomorpha lini n. sp. (Figs. 1a–f)

This species seems to fit near *quartarius* (Brunetti), from India but his description of the type female is so sketchy that few diagnostic features are given. He states that the r-m crossvein is situated at basal fourth of cell 1st M_2 and the ovipositor is of "moderate length". In *lini* the r-m is extremely basad, situated at or below basal sixth of cell 1st M_2 and the ovipositor is rather short (Fig. 1f). Brunetti gave the body measurement as 1.75 mm., the female of *lini* measures 2.7 mm.

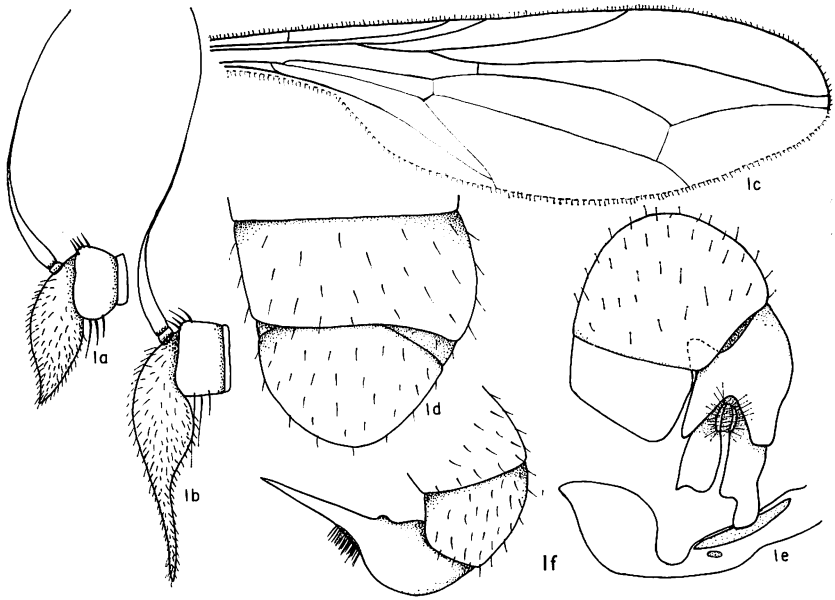

FIG. 1. *Dorylomorpha lini* n. sp. a. male antenna; b. female antenna; c. wing; d. terminal portion of male abdomen, dorsal; e. male genitalia, ventral; f. female ovipositor.

In my key to Pipunculidae of the Pacific and bordering Asiatic countries this would key in the second part of couplet 74 (Hardy 1968: 433), fitting the key character for *Tomosvaryella* by lacking a brown marking in the subcostal cell. The following couplet should be substituted for 74:

Eyes of male joined or extending very close together for at least a short distance on the front; r-m crossvein not situated basad of one-fourth the length of cell 1st M_2. Anal cell, axillary lobe and alula well developed.....74A

Eyes of male distinctly separated by a width approximately equal to two rows of eye facets; r-m crossvein situated at basal sixth of cell 1st M_2 (Fig. 1c); alula lacking or reduced to a very narrow strip, no axillary lobe present...Philippines and Taiwan.....*Dorylomorpha lini* n. sp.

Except for *quartarius* (Brunetti) this is the smallest of the known *Dorylomorpha* and the body form is more like that of *Pipunculus*. The abdomen is nearly straight sided, scarcely enlarged posteriorly as seen in dorsal view. It would also differ from other known *Dorylomorpha* by lacking the row of bristles, or long setae, on sides of first abdominal tergum; by having the thorax and abdomen rather densely gray-brown pollinose and male genitalia symmetrical, lacking a membranous area on the eighth segment. Also genitalia as in Fig. 1e.

Male. Head: Approximately as long as high with the eye margin slightly curved on upper half so the upper portion of occiput is broader than lower. Occiput dark gray to blackish above, gray pubescent on sides and below. Vertex, ocellar triangle, and upper two-thirds of front polished black. Lower front and face silvery pubescent. Separation of eyes almost equal to two rows of eye facets. Face straight sided, equal in width to front immediately above antennae. First two antennal segments black, third segment dark brown at base, yellow on apical portion and acute at apex as in Fig. 1a. *Thorax:* Polished in ground color and densely covered with gray-brown pollen over dorsum, gray on sides and over metanotum. A row of fine inconspicuous setae extends down each dorsocentral line. Scutellum with rather prominent yellow marginal setae and with scattered erect setae over disk. Humeri and halteres yellow. Propleura bare. *Legs:* Coxae and trochanters black, except for extreme yellow apices of latter. Tibiae broadly yellow on bases and extreme apices, otherwise black, basitarsi yellow, other tarsomeres verging from brownish yellow to dark brown at apex. Ventral margin of each hind trochanter densely white pubescent. Femora lacking posterior cilia and hind tibiae lacking anterior setae or bristles. *Wings:* Lightly fumose, very slender basally, venation as in Fig. 1c. Third costal section (subcostal cell) very short, about one-fourth as long as fourth section; third and fourth combined are subequal to the fifth section. Crossvein r-m situated at basal sixth of cell 1st M_2. Last section of vein M_{1+2} slightly curved and apices of veins R_{4+5} and M_{1+2} extend almost parallel for a short distance. Last section of vein M_{3+4} subequal to m crossvein. Anal cell greatly reduced, the basal portion is obliterated, also there is no axillary lobe and the alula is extremely narrow, represented by a very thin strip of membrane. *Abdomen:* Almost straight sided, slightly swollen posteriorly as seen in direct dorsal view. First tergum and sides of second gray pollinose, otherwise brown pollinose, faintly subshining. Eighth tergum symmetrical, round, lacking a membranous area (Fig. 1d); basal portion of ninth tergum (epandrium) visible from dorsal view. Eighth segment approximately equal in length to fifth. As seen from ventral view the genitalia are as in Fig. 1e. The seventh tergum is closely fused with the eighth. The sixth is well developed on the right hand side, concave in the median portion. The ninth tergum (epandrium) is nearly two times longer than wide and with a deep V-shaped cleft in middle of hind margin. The surstyli (claspers) are asymmetrical, indistinctly bilobed.

Length: body 2.5–2.7 mm. wings 3.0 mm.

Female. The front is broad, eyes widely spaced, slightly broadest at upper median portion. Vertex, ocellar triangle and upper half-two-thirds of front polished black and with a polished point extending into the silvery gray pubescent area of lower portion of front. Antennae with

the third segment yellow, tinged slightly with brown at base and long acuminate (Fig. 1b), with the point approximately equal in length to the base. Abdomen with the sixth tergum well developed, approximately equal in length to the fifth. Ovipositor rather short, with the base subglobose and the piercer about equal in length to the basal portion and extending approximately to the apex of the third abdominal segment (Fig. 1f).

Length: body 2.7 mm; wings 3.2 mm.

Holotype male 13 Km N. of Puerto Princesa, Palawan, Philippines. April 15–17, 1968. Swept on roadside grasses (M. D. Delfinado). Allotype female, same data as type (D. E. Hardy). Ten paratypes, seven males, three females, five same data as type and five Taipei, North Taiwan, sweeping over rice paddy. June 12–26, 1969 and September 12, 1970 (K. S. Lin).

Type and allotype in B. P. Bishop Museum. Paratypes in Taiwan Agricultural Research Institute and University of Hawaii Collection.

This species is named after Dr. Kwei-shui Lin, Taiwan Agricultural Research Institute, who has done a thorough study of Pipunculidae associated with rice leafhoppers on Taiwan.

Tomosvaryella oryzaetora Koizumi

Tomosvaryella oryzaetora Koizumi, 1959. Sci. Rept. Fac. Agric. Okayama University 13: 38, Figs. 1a–f.

Type-locality: Okayama City, Japan.

Alloneura oryzaetora (Koizumi), 1960. Sci. Rept. Fac. Agric. Okayama University 16: 34.

Host: Reared from *Nephotettix cincticeps* Uhler in Japan and Taiwan and collected in rice paddies in the Philippines, Sabah, and Malaya.

Distribution: Previously known only from Japan. The species is widespread over the Oriental Region, numerous specimens have been seen from the following localities. Taiwan: Taipei, May–Aug., 1968–69, reared (K. S. Lin). Philippines: Cabuyao, Laguna, Luzon, Apr. 3, 1968 border of rice field (D. E. Hardy); Los Banos, Luzon, May, 1969, in paddy field (no collector given); Manila, Luzon, Feb.–Sept., 1914 (Baker); Pili, Camarines Sur, Luzon, Sept. 19, 1964 (K. Yasumatsu). Maninit Str., Manolo Fortich, Bukidnon, Mindanao, Apr. 24, 1968 (M. D. Delfinado). Malaya: Malacca, Sept. 16, 1964, in paddy field (Y. Hirashima). Sabah: Paper, Sept. 23–24, 1964, in paddy field (Y. Hirashima); Tuaran, Sept. 21–29, 1964, in paddy field (Y. Hirashima). India: Chabua, Assam, Dec. 12–20, 1943 (D. E. Hardy). Thailand: Sampatong, Dec. 9–13, 1962 (A. Nagatomi).

The species is readily differentiated by having the wings tinged with brown, the humeri black, abdomen lightly pollinose on dorsum, gray on sides and by the other details given in the key above. The original description and figures are adequate but it should be noted that the bristles

on the sides of the first tergum are yellow-white and each hind femur has an almost complete row of long yellow setae (cilia) on posteroventral surface.

Tomosvaryella spiculata n. sp. (Figs. 2a–c)

This species fits very near *micronesiae* Hardy, from the Mariana and Caroline Islands because of the external appearance of the male terminalia and by the presence of a strong carina on venter of each hind trochanter (Fig. 2a). It differs by having the raised area on hind trochanter extending obliquely over the segment and thickly covered with short black spicules, rather than the raised area extending longitudinally, densely covered with white pubescence but lacking spicules or setae; third costal section about one-third as long as fourth, rather than one-half to two-thirds as long; crossvein r-m situated distinctly before middle of cell 1st M_2, rather than at middle; and by having the surstyli nearly straight sided, concave on inner margins (Fig. 2c), rather than with sides curved, apices enlarged and inner margins not concave (Ref. Fig. 1c, Hardy, 1956: 3).

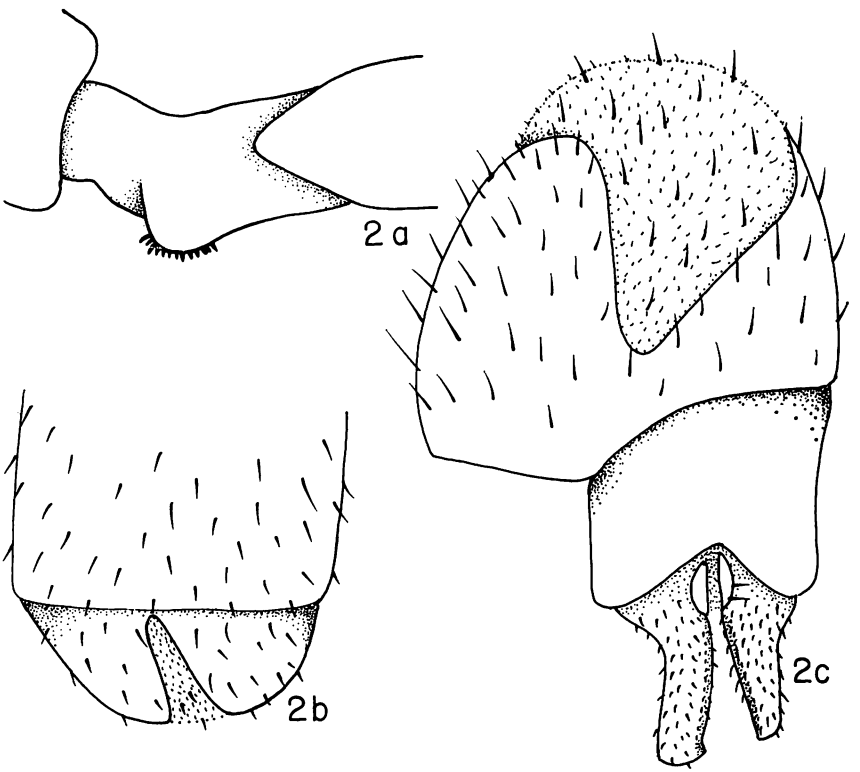

FIG. 2. *Tomosvaryella spiculata* n. sp. a. hind trochanter of male; b. terminal portion of male abdomen, dorsal; c. male genitalia, ventral.

In other respects fitting the description of *micronesiae*, I see no other diagnostic features. The third antennal segment is moderately acuminate, yellow, tinged with brown. The junction of the compound eyes is short, equal in length to about six rows of eye facets. The humeri and halteres are yellow. The dorsocentral row of setae are very prominent and the setae on the margin of the scutellum small, inconspicuous. Legs mostly black, the obliquely placed raised area on the hind trochanter has a row of closely spaced black spicules (Fig. 2a). Wings faintly infuscated, venation as mentioned above. Abdomen subshining black, lightly gray pollinose. Terminal portion of abdomen as in Fig. 2b. As viewed *in situ*, from above, the membranous area appears to bisect the eighth segment. In specimens cleared in KOH and phenol the membrane does not extend to the anterior margin of the segment. The ventral aspects of the genitalia are as in Fig. 2c. The concavity on hind margin of the epandrium is rather shallow.

Length: body and wings, 2.6–2.8 mm.

Female unknown. The males were collected in close association with specimens of *sylvatica* (Meigen) and a good series of females are present but cannot be separated from the latter species.

Holotype male, Pingtung, S. Taiwan, Oct. 5, 1970, sweeping over paddy field (K. S. Lin). Three male paratypes, two from Taipei, N. Taiwan, June 26, 1969, sweeping (K. S. Lin) and one Los Banos, Luzon, Philippines, May, 1969 (no collector given).

Type and one paratype returned to the Taiwan Agricultural Research Institute and one paratype each in B. P. Bishop Museum and the University of Hawaii collection.

Tomosvaryella subvirescense (Loew)

Pipunculus subvirescens Loew, 1872. Berl. Ent. Zeitsch. 16: 87.

Type-locality: Texas.

Pipunculus similans Becker, 1924. Ent. Mitteil. 13(1): 15.

Type-locality: Taihoku, Taiwan.

For numerous synonyms under this species refer to Hardy, 1956: 4.

Hosts: *Nephotettix cincticeps* and probably other grass inhabiting leafhoppers.

Distribution: Widespread over much of the world.

Numerous specimens have been seen from many localities over the Philippines (some in paddy fields), Taiwan (reared), Thailand, Laos and India.

The species is easily recognized by the hemispherical, symmetrical terminalia of the male and by the conspicuous square-topped process on each hind trochanter of the male. It has been adequately described and figured by Hardy, 1956: 4, Figs. 2a–c.

Tomosvaryella sylvatica (Meigen)

Pipunculus sylvaticus Meigen, 1824. Syst. Beschr. Eur. Zweifl. Ins. 4: 20.

Type-locality: Europe.

Host: *Nephotettix cincticeps* Uhler, in Taiwan and probably other places and *Psamotettix striatus* (Linn.) in USSR and possibly Japan, etc.

Distribution: Widespread over Palaearctic, Nearctic and Ethiopian Regions. Also apparently widespread over the Oriental Region although it seems scarce compared to other species which occur in the rice fields.

I have seen specimens from the following localities. Taiwan: Pingtung, June 26, 1970, in paddy field (K. S. Lin); Taipei, July, 1969–May 27, 1970, reared from *Nephotettix cincticeps* (K. S. Lin); and Ping Tong, March 10, 1970, sweeping (K. S. Lin). Burma: Kambaiti, 7,000 ft., May 24, 1934 (R. Malaise); and Thailand: Chiangmai, Nov. 1, 1963 (no collector given).

This species is differentiated by having a longitudinal furrow dividing the male terminalia into two parts, as seen from dorsal view *in situ* and by the slender, nearly straight sided surstyli.

The species has been adequately described and figured by Koizumi (1960: 39, Fig. 4a–e).

Pipunculus (Eudorylas) javanensis de Meijere

Pipunculus javanensis de Meijere, 1970. Tijds. Ent. 50: 262.

Type-locality: Semarang, Java. Type male in Zoological Museum, Amsterdam. I have studied the type.

Pipunculus formosanus Kertész, 1912. Ann. Mus. Nat. Hung. 10: 298.

Type-localities: Takao and Tainan, Taiwan.

New synonym, based upon comparison of specimens from many localities over the Oriental Region with specimens from Taiwan which fit the original description, some in Deutsches Entomologisches Institut collection determined *formosanus* by Hennig.

Pipunculus transversus Brunetti, 1923. The fauna of British India, including Ceylon and Burma, Diptera vol. III. Pipunculidae, Syrphidae, Conopidae, Oestridae. p. 13, Fig. 4.

New synonymy, based upon a study of type male.

Type-locality: Pusa, India. Type ♂ in British Museum (Nat. Hist.).

Dorilas (Eudorylas) tsuboii Koizumi, 1959. Sci. Rept. Fac. Agric. Okayama Univ. 13: 40, Figs. 2a–f.

Type-locality: Tsushima, Okayama City, Japan.

Pipunculus (Eudorylas) javanensis de Meijere, Hardy, 1968. Ent. Meddel. 36: 451, Figs. 19a–d.

Host: *Nephotettix cincticeps* Uhler.

Distribution: Japan, and widespread over Oriental region. Numerous specimens seen from the following localities. Taiwan: Taipei August 20–25, 1970, reared from *Nephotettix* (K. S. Lin). Philippines: Cabuyao, Laguna, Luzon, April 3, 1968, on border of rice field (D. E. Hardy); Brookes Point, Uring Uring, Palawan, Sept. 24, 1961 (Noona

Dan Exped.). India: Chabua, Assam, Nov.–Dec., 1943 (D.E. Hardy). Borneo: Tenompok, 1460, Jesselton, 30 mi. E., Feb. 19, 1959 (T. C. Maa). Sabah: Paper, Nov. 24,1964, in paddy field (Y. Hirashima). Laos: Pakse, Sedone Prov., May 13, 1965 (P. D. Ashlock). Thailand: Sampatong, Dec. 8–9, 1962 (A. Nagatomi); Ubal, Dec. 20, 1962 (A. Nagatomi); Doi Sked, Dec. 16, 1962 (A. Nagatomi); Fang, Dec. 4, 1962 (A. Nagatomi). Java: Tjibodas, Mt. Gede, no date or collector.

This species is recognized by the rather quadrate terminalia of the male, with a large membranous area and by the short up-curved ovipositor of the female in combination with the characters pointed out in the key above. The descriptions and figures by Koizumi (*loc. cit.*) and Hardy (*loc. cit.*) are adequate.

Pipunculus (Eudorylas) mutillatus Loew

Pipunculus mutillatus Loew, 1857. K. Svenska Vetensk. Akad. Öfvers. Förh. 14: 374.

Type-locality: Caffraria, S. Africa.

Dorilas (Eudorylas) cruciator (Perkins), Koizumi, 1959. Sci. Rept. Fac. Agric. Okayama Univ. 13: 41, Figs. 3a–f.

For synonymies refer to Hardy 1968: 456.

Host: *Nephotettix cincticeps* Uhler, *Hecalus* sp. and probably other leafhoppers.

Distribution: Widespread over Asia, Pacific and Africa.

A large series of specimens have been seen from many localities over the Philippines, Taiwan, Sabah, Thailand, India and Japan. Many collected in paddy fields and reared from *Nephotettix cincticeps* in Taiwan and Japan.

The species is recognized by the longitudinal cleft down the right side of the male terminalia, the short curved ovipositor of the female; in combination with yellow third antennal segment, largely yellow legs, etc. The description by Koizumi (*loc. cit.*) is good. Also refer to Hardy, 1968: 456, Figs. 24a–b.

Pipunculus (Eudorylas) orientalis (Koizumi) (Figs. 3a–d)

Dorilas (Eudorylas) orientalis Koizumi, 1959. Sci. Rept. Fac. Agric. Okayama Univ. 13: 43, Figs. 4a–c.

Type-locality: Okayama City, Japan.

Eudorylas orientalis Koizumi, 1960. Sci. Rep. Fac. Agric. Okayama Univ. 16: 41, Figs. 5a–3.

Pipunculus (Eudorylas) orientalis Koizumi, Hardy, 1968. Ent. Meddel. 36: 459, Figs. 26a–c.

Host: *Nephotettix cincticeps* Uhler.

Distribution: Japan, Bismarck Islands and widespread over the Oriental Region. I have seen a large series from the following localities. Taiwan: Taipei, June–July, 1969, reared from *Nephotettix* (K. S. Lin). Burma: Kambaiti, 7,000 ft., Apr.–May, 1934 (R. Malaise). India:

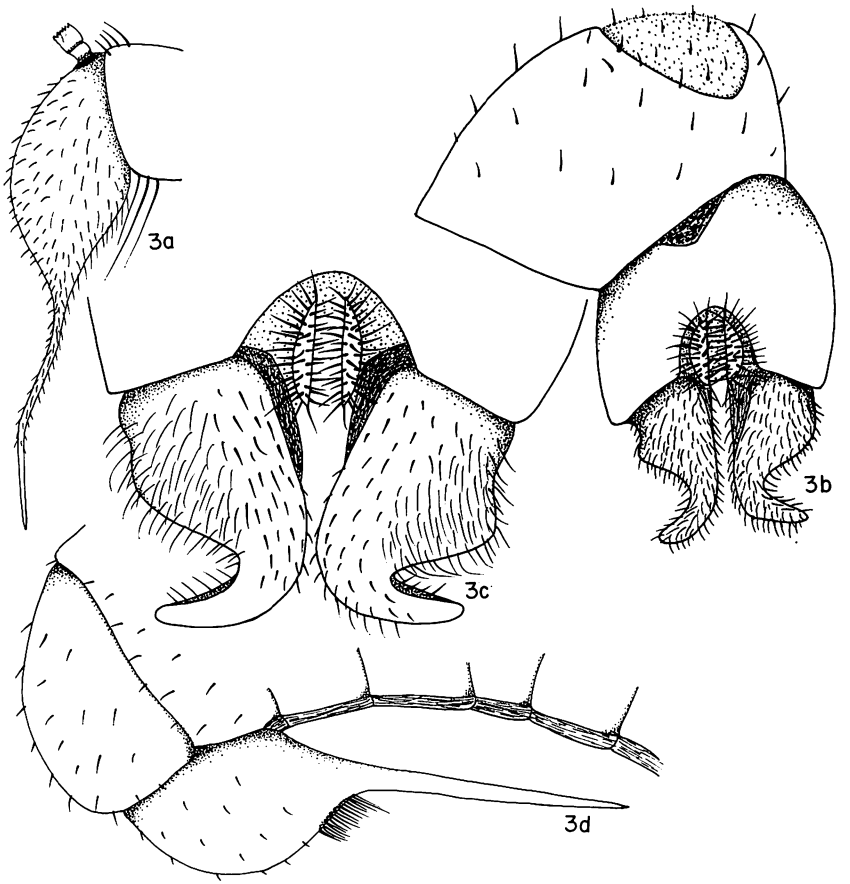

FIG. 3. *Pipunculus* (*Eudorylas*) *orientalis* (Koizumi). a. antenna; b. male genitalia, ventral; c. surstyli of male; d. female ovipositor.

Chabua, Assam, Dec., 1943–Mar. 30, 1944 (D. E. Hardy). Thailand: Fang, Dec. 3, 1962 (A. Nagatomi); Khorat Prov., Sakaerat, 300 km. N. E. Bangkok, Feb. 29–Mar. 3, 1968 (D. E. Hardy); Meatang, Dec. 12, 1962 (A. Nagatomi); Chiangmai Prov., Chiangmai (arboretum), 300 m., June 12, 1965 (P. D. Ashlock). Vietnam: Fyan, 900–1,000 m., July–Aug., 1961 (N. R. Spencer); Di Linh (Djiring), 1,20 m., Apr. 22–28, 1960 (S. Quate); Mt. Lang Bian, 1,500–2,000 m., May–June, 1961 (N. R. Spencer).

This belongs to a complex of species characterized by having vein Cu_1 + 1st A about equal in length to the last section of vein M_{3+4}; third section of costa two or more times longer than fourth; 1st section of vein M_{1+2} straight; third antennal segment long accuminate, rather bristle-like at apex in female; first two pairs of tibiae each with an erect black

seta (bristle-like) on posterior surface near apical third to two-fifths of segment; and male terminalia with a prominent membraneous area extending over apex. The species are separated by the male genital characters. Three other species are presently recognized in this complex, *monothrix* Hardy and two new species from Thailand and Laos, in press.

This species has been adequately described and figured by Koizumi (*loc. cit.*). It is differentiated by having the legs chiefly black and by the shape of the surstyli, these are rather strongly tapered, curved outward at their apices (Figs. 3b–c). Legs marked with yellow only on narrow apices of femora, bases of tibiae and on basal four tarsomeres. The abdomen is predominantly velvety black, gray on sides and with rather faint gray fasciae on posterior margins of terga; in some specimens the abdomen is entirely velvety black. The membranous area over eighth segment is very large and almost completely bisects the segment on both dorsal and ventral portions. The third antennal segment in the male terminates in a sharp point which is about two-fifths as long as the basal portion of third segment, while the attenuated portion in the female is equal or slightly longer than the basal portion (Fig. 3a). The front of the female is polished black through the median portion on the upper two-thirds. Koizumi indicated that the humeri are yellow, or dirty yellow. In all of the specimens I have examined the humeri are dark colored brown to black. The female ovipositor is straight, shaped as in Fig. 3d.

Pipunculus (Eudorylas) roralis (Kertész)

Dorilas roralis Kertész, 1915. Ann. Mus. Nat. Hung. 13, 389, Figs. 3a–c. Type-locality: Tainan, Taiwan.

Pipunculus (Eudorylas) roralis (Kertész), Hardy, 1968. Ent. Meddel. 36: 461, Figs. 29a–e.

Host: *Nephotettix cincticeps* Uhler, new host record.

Distribution: Widespread over the Oriental Region. I had previously recorded it from Tawi Tawi, S. W. Sulu Archipelago, Philippines. I have since examined numerous specimens for the following localities. Taiwan: Taipei, 10–15 m., Nov. 10, 1915, July 4–8, 1958, Dec., 1968 and June 27, 1970, the latter reared from *Nephotettix* (H. Sauter and K. S. Lin); Taipei Hsien, Peitou, 50 m., Nov. 20, 1957 (T. C. Maa); Chiayi Chiayi Hsien, April 12–13, 1965, malaise trap (C. M. Yoshimoto and B. D. Perkins); Kuraru, Hengchun Park, 250 m., April 2, 1965 (C. M. Yoshimoto); Taipei Hsien, Santiaolina, 100–400 m., Nov., 1957 (T. C. Maa). Philippines: 13 km. N. Puerto Princesa, Palawan, April 15–17, 1968, collected sweeping in grass (D. E. Hardy and M. D. Delfinado); Mt. Empagatao Camp II, Misamis Or., Mindanao, April 21, 1961, in forest (H. M. Torrevillas). Thailand: Fang, Nov. 26–Dec. 2, 1962 (A. Nagatomi); Sampatong, Dec. 13, 1962 (A. Nagatomi); Trang Prov., Khaophappha Khaochang, 200 m., Jan. 11–15, 1964 (G. A. Samuelson); Chiangmai Prov., Chiangdao, 450 m., Apr. 5–11, 1958 (T. C. Maa);

Pangmakampon (Pankamgawng) nr. Fang, 450 m., Nov. 16, 1957 (J. L. Gressitt); Si Racha, Aug. 21, 1963 (no collector given). Laos: Vientiane, May 27, 1965 (P. D. Ashlock); Phou-Kow-Kuei, 800 m., Apr. 17, 1965 (J. L. Gressitt). Vietnam: Kontum, N. of Pleiku, 550 m., May 13, 1960 (L. W. Quate); Dak Song, 76 km. S. W. of Ban Me Thout, 870 m., May 19–21, 1960 (L. W. Quate).

Fitting close to *macropygus* de Meijere by lacking lateral bristles on the first tergum and the terminal segment of the male abdomen subglobose, lacking a membranous area and with the epandrium plainly visible from dorsal view. It is differentiated by having the terminal portion of the abdomen (eighth segment) about as wide as and only slightly longer than fifth tergum, rather than much broader and about two times longer than fifth; the abdomen mostly opaque gray, rather than shining black; and the inner surstylus tapered, rather than almost square. Refer to Hardy 1968: 461, Figs. 29a–e for a more detailed description.

REFERENCES CITED

Hardy, D. E. 1956. Insects of Micronesia Diptera: Dorilaidae (Pipunculidae). B. P. Bishop Mus. Ins. Micronesia **13**(1): 1–9, 6 Figs.

——1968. Bibionidae and Pipunculidae of the Philippines and Bismarck Islands. Ent. Meddel. **36:** 417–507, 62 Figs.

Koizumi, K. 1959. On four Dorilaid parasites of the Green Rice Leafhopper, *Nephotettix cincticeps* Uhler (Diptera). Sci. Rept. Fac. Agric. Okayama Univ. **13:** 37–46, 4 Figs.

——1960. A new Dorilaid parasite of the Zigzag-striped Leafhopper, *Inazuma dorsalis* (Motschulsky) and notes on other paddy-field inhabiting Dorilaidae (Diptera). Sci. Rept. Fac. Agric. Okayama Univ. **16:** 33–42, 5 Figs.